Tribhuvan University
Institute of Science and Technology
Model Question Paper

Bachelor Level/ First Year/ Second Semester/ Science — Full Marks: 60
Computer Science and Information Technology (STA 159) — Pass Marks: 24
(Statistics II) — Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.

The figures in the margin indicate full marks.

All notations have the usual meanings.

Group A

Attempt any two questions: (2x10=20)

1. In two stage sampling with simple random sampling without replacement at both stages obtain an expression for an unbiased estimator of the population total, and derive the expression for the unbiased estimator. Hence, in particular case (when $M_i = M$ and $m_i = m$ for all i), obtain the simplified version of the unbiased estimator and variance of the unbiased estimator.
2. What do you mean by Latin Square Design? Write and explain the statistical model for a p x p Latin Square Design. Give the statistical analysis of p x p Latin Square Design with one observation per cell.
3. (a) What is a sample survey? What are the important steps in sample survey?
   (b) What do you mean by experimental design in statistics? Why it is important in the scientific research?

Group B

Answer any Eight (8x5=40)

4. Explain the terms sampling and non-sampling error.
5. Explain in brief the principles of experimental design.
6. A rural block is a district was divided into three strata. The following table gives the number of villages (N_h), area under wheat crop (X_h) and standard deviation (S_{xh}) of area under wheat crop for different strata.

Stratum number (h)	Number of villages (N_h)	Area under wheat crop in hectare (X_h)	Standard deviation of area under wheat crop (S_{xh})
1	15	625	110.5
2	10	670	80.7
3	30	1055	160.8

A sample of 10 villages is to be drawn. How many villages should be selected from different strata in case of (a) proportional allocation and (b) optimum allocation?

7. In a one-way ANOVA, show that
   Total sum of squares = SS with groups + SS between groups
8. Explain the differences between ratio and regression method of estimation.

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9. What do you understand by factorial experiment? Discuss the main effect and interaction effect in 2^2 factorial experiment.
10. What is a two-way ANOVA? Describe its ANOVA table.
11. Derive variance of the sample mean in the case of systematic sampling when N = nk.
12. In a simple random sampling without replacement of n clusters from a population of N clusters containing M elements. Derive an expression for the variance of sample mean per element.
13. A firm wishes to compare four programs for training workers to perform a certain manual task. Twenty new employees are randomly assigned to the training program with five in each program. At the end of the training, a test is conducted to see how quickly trainees can perform the task. The number of times the task is performed per minute is recorded for each trainee, with the following results:

Program 1	9	12	14	11	13
Program 2	10	6	9	9	10
Program 3	12	14	11	13	11
Program 4	9	8	11	7	8

Estimate the treatment effects for the four program.

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